

Consolidated reprint  
incorporates Changes 1 and 2

AC 150/5345-26B

DATE 1/28/81

# ADVISORY CIRCULAR



DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

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**Subject:** SPECIFICATION FOR L-823 PLUG AND RECEPTACLE, CABLE CONNECTORS

1. PURPOSE. This advisory circular contains a specification for plugs and receptacles (cable connectors) used with underground power cable, isolation transformer leads, and light fixture leads for airport lighting systems.
2. PRINCIPAL CHANGES. This revision adds test requirements for sunlight and ozone resistance, deletes references to 3,000-volt ratings, deletes figure 11, renumbers figures in sequence, includes metric dimensions, adds figure 5, and changes connector designation marking from figure number to style number.
3. CANCELLATION. This advisory circular cancels and replaces AC 150/5345-26A, Specification for L-823 Plug and Receptacle, Cable Connectors, dated May 4, 1971.
4. METRIC UNITS. To promote an orderly transition to metric units, the specification includes both English and metric dimensions. The metric conversion may not be exact equivalents, and until an official changeover to metric units is effected the English dimensions will govern.

*Leonard E. Mudd*  
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Initiated by: AAS-200



## SPECIFICATION FOR L-823 PLUG AND RECEPTACLE, CABLE CONNECTORS

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification contains requirements for plugs and receptacles (cable connectors) to be used for underground cable connections, for isolation transformer leads, and for airport light fixture leads.

1.2 Classification. Cable connectors are classified by this specification into two types, two classes, and six styles of plugs and two types, two classes, and six styles of receptacles. Formerly, cable connectors were classified only by a figure number. Figures in this specification are now numbered consecutively. To aid in connector reference and identification, former figure numbers are included in 1.2.3.

1.2.1 Type. Plugs and receptacles with the following electrical characteristics are covered by this specification:

- Type I 1 conductor, 25 ampere, 5,000 volt
- Type II 2 conductor, 20 ampere, 600 volt

1.2.2 Class. Plugs and receptacles with the following attachment method are covered by this specification:

- Class A Factory molded to wire or cable
- Class B Field attached to conductor(s)

1.2.3 Style. Plugs and receptacles with the following styles of housings are covered by this specification:

- Style 1 Plug, figure 1(a)
- Style 2 Plug, figure 2(a) (formerly figure 6(a))
- Style 3 Plug, figures 3(a), 3(c), 3(e) (formerly figures 14(a), 14(c), 14(e))
- Style 4 Plug, figure 4a & 4b (formerly figures 15a & 15b)
- Style 5 Plug, figure 4e & 4f (formerly figures 15e & 15f)
- Style 6 Plug, figure 5
- Style 7 Receptacle, figure 1(b)
- Style 8 Receptacle, figure 1(c)
- Style 9 Receptacle, figure 2(b) (formerly figure 6(b))
- Style 10 Receptacle, figures 3(b), 3(d), 3(f) (formerly figures 14(b), 14(d), 14(f))
- Style 11 Receptacle, figure 4c & 4d (formerly figures 15c & 15d)
- Style 12 Receptacle, figure 4g & 4h (formerly figures 15g & 15h)

2. APPLICABLE DOCUMENTS.

2.1 General. The following documents, of the issue in effect on the date of application for qualification, form part of this specification and are applicable to the extent specified herein.

2.1.1 Federal Aviation Administration (FAA) Standard.

FAA-STD-013      Quality Control Program Requirements

2.1.2 American Society for Testing and Materials (ASTM) Specifications.

- B 33      Tinned Soft or Annealed Copper Wire for  
Electrical Purposes, Specification for
- B 189      Lead-Coated and Lead-Alloy-Coated Soft Copper  
Wire for Electrical Purposes, Specification for
- B 1149      Rubber Deterioration-Surface Ozone Cracking in a  
Chamber (Flat Specimens), Test for

2.1.3 Insulated Cable Engineers Association (ICEA) Standard.

S-19-81      General Specifications for Wire and Cable with  
Rubber, Rubber-Like, and Thermoplastic  
Insulations

2.1.4 Underwriters Laboratories (UL) Publication.

UL-62      Flexible Cord and Fixture Wire

(Copies of FAA standards may be obtained from the Federal Aviation Administration, Airway Facilities Service, Washington, D.C. 20591.)

(Copies of ASTM specifications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Copies of ICEA publications may be obtained from the National Electrical Manufacturers Association (NEMA), 2101 L Street, N.W., Washington, D.C. 20037.)

(Copies of UL publications may be obtained from Underwriters Laboratories, 207 East Ohio Street, Chicago, Illinois 60611.)

3. REQUIREMENTS.

3.1 General. Plugs and receptacles (cable connectors) shall be fabricated in accordance with all specification requirements.

3.2 Environmental Requirements. The plugs and receptacles (connectors) shall be designed for continuous use within a temperature range of -55°C to +65°C while exposed to weather, submerged in water, or buried in the earth.

3.3 Performance Requirements.

3.3.1 Electrical Connection. The electrical rating of each connector shall not be less than the values required for their type in 1.2.1. The voltage drop across the contacts of a connected plug and receptacle shall not exceed 7.5 millivolts for the Type I connectors nor 6.0 millivolts for the Type II connectors.

3.3.2 Bonding Strength. The bond between the cable and the molded-on plug or receptacle shown on figure 1 shall withstand a pull of at least 75 percent of the test force required in determining the mechanical strength of a completed cord as set forth in ICEA Standard Publication S-19-81, Table 7.7-8, Strength of Completed Cord. Cord conductors not covered by this table and cable bonded to the molded-on plug or receptacle shown on figure 2 shall withstand a pull of at least 30,000 psi (207 MPa). This value is based on 75 percent of an average tensile strength of 40,000 psi (276 MPa) for all wire sizes. The wires are in accordance with ASTM Specification B 33 and B 189.

3.3.3 Mechanical Connection. Each connected plug and receptacle shall withstand a static pull load of 10 pounds (44 N) without showing evidence of separation.

3.3.4 Seal. A watertight seal shall be provided between the mated plug and receptacle and between rubber and metal parts of the plug and receptacle.

#### 3.4 Fabrication and Materials.

3.4.1 General. Each connector shall conform to the requirements shown on the applicable figure.

3.4.2 Housing. The connector housing shall be molded from natural and/or synthetic elastomeric materials serving both as insulation and sheath to fully enclose the pins and sockets of the connectors. The material shall be suitable for direct earth burial, submergence in water, and capable of withstanding limited chemical, oil, or gasoline attack. Housings for Class A connectors shall be fabricated from materials capable of bonding to cable sheaths or conductor insulation, during the vulcanizing process, to provide a watertight bond. Material compounds used in connector housings shall not contain more than 25 pounds (11 kg) of carbon black per 100 pounds (45 kg) of elastomer. Housings for Class B connectors shall withstand exposure to direct sunlight and to ozone.

3.4.3 Pins and Sockets. The pins and sockets shall be designed to conform to the dimensional and construction requirements as indicated on the applicable figure of this specification. The sockets shall be slotted and spring loaded to insure good electrical contact as required by paragraph 3.3.1. Pins and sockets provided for Class B connectors shall have provisions for crimping to the cable conductor(s) at a job site. The metal of the pins and sockets for connectors shall not exhibit damage after crimping. Pins and sockets shall be made of materials that contain at least 98 percent copper. Sockets shall be fully annealed and supplied with a copper beryllium sleeve-type spring which assures adequate contact pressure and protects the socket slots from filling with insulating compound during assembly and subsequent use. The pins shall be made from material at least "half hard" with the crimping section fully annealed. The contact portion of the pin shall be left "stock hard." The hardness transition shall be limited to the locking section of the pin. The pin and socket shall be electro-plated with tin or other suitable material to provide good electrical contact. The pin for the Style 3 connector shall be provided with a visual indication that verifies proper assembly position.

#### 3.4.4 Connector Assemblies.

3.4.4.1 Class A. Pins and sockets shall be held perpendicular to the face of the block. Suitable electrical conductors shall be mechanically and electrically connected to the pin(s) or socket(s), and then the housing shall be molded per 3.4.2. Do not mold a connector to an electrical conductor or cable having a higher voltage rating than the specification requirements for the connector. After molding, the space between dual pin connectors shall be not less than 1/8 inch (3 mm) when the pins are pinched together with a force of 6 pounds (27 N) applied 1/2 inch (12.7 mm) out from the face of the plug. Also, the space between the ends of the pins shall not be greater than 9/16 inch (14.3 mm) when the pins are pulled apart with a force of 6 pounds applied 1/2 inch (12.7 mm) out from the face of the plug. The force is applied to the pins only. The plug is to be held only to keep it from turning.

#### 3.4.4.2 Class B.

3.4.4.2.1 Type I. Connectors shall be fabricated to the dimensions shown on figure 3. Each receptacle shall be equipped with a disposable sleeve made of high density (linear) polyethylene fitted into the receptacle's water seal to catch surplus silicone compound upon assembly. Each socket shall be equipped with a disposable pin, made of high density (linear) polyethylene, fitted tightly into the pin end of the socket to prevent entry of silicone compound on assembly and to provide a visual indication of proper socket position after assembly. The pin design shall be such that proper internal dispersion of silicone compound in the assembly is assured. An adequate amount of silicone insulating compound shall be furnished with each connector to insure filling all internal voids when the connector is assembled. Each housing shall be capped with a disposable shipping cap on the cable entrance end. The cap shall have a small pin hole in it large enough to allow air venting of the pothead chamber but small enough to prevent the escape of the silicone compound.

3.4.4.2.2 Type II. Connector assemblies shall be composed of two parts, an insert assembly and a housing. Pins or sockets shall be held perpendicular to the face of each end of the molded insert assembly and fastened so that, when molded, they will comply with the requirements of 3.4.4.1. Inserts and housings shall be molded as specified in 3.4.2 and of the dimensions and styles as shown on figure 4. When plug and receptacle assemblies are assembled, they shall provide a watertight seal to prevent moisture from entering the housing.

3.4.5 Marking. Each plug and receptacle shall be marked with the manufacturer's identification and L-823 designation with style number, i.e., L-823, Style 3.

3.4.6 Caps. Caps, where required to protect plugs and receptacles prior to final connection, shall be made of a plastic material compatible with the housing materials in 3.4.2. When a series short circuiting plug-type cap is required for a receptacle, internal jumpers shall be connected to the proper pins. The mating dimensions shall be the same as the corresponding plug. The short circuiting cap shall have a red "S" molded on it.

3.4.7 Instructions. Installation instructions shall be furnished with each Class B connector.

#### 4. QUALITY ASSURANCE PROVISIONS.

##### 4.1 Qualification Requirements.

4.1.1 Qualification Request. Requests for qualification approval must be submitted in writing to the Office of Airport Standards, Attention: AAS-200, Federal Aviation Administration, Washington, D.C. 20591. This request must include:

- a. A list of the types, classes, and styles of connectors, along with the manufacturer's catalog numbers, for which qualification approval is requested. A list of equipment options should also be included when specified in individual equipment specifications.
- b. A copy of proposed test procedures and test data sheets and a statement as to whether the manufacturer proposes to conduct the tests or name and location of the independent testing laboratory where the tests are to be conducted (4.1.2).
- c. A copy of the manufacturer's proposed guarantee for the equipment (4.1.4).
- d. A copy of the manufacturer's quality control plan (4.1.3).
- e. A preliminary copy of installation instructions (3.5.7).

4.1.2 Qualification Testing. The connectors must pass all tests in 4.2. The manufacturer shall supply all test equipment and bear all testing costs. Tests may be conducted at the manufacturer's plant, if facilities are available, or at an independent test laboratory acceptable to the FAA. The FAA reserves the right to witness any or all tests. Where the FAA waives the option to witness tests, the manufacturer must submit a certified copy of all test reports.

4.1.3 Quality Control Provisions. The manufacturer shall provide and maintain a quality control program in accordance with FAA-STD-013 except that facilities for an FAA Quality Assurance Representative are not required.

4.1.4 Guarantee. The manufacturer shall provide the following minimum guarantee for each connector: That the connector has been manufactured and will perform in accordance with this specification and that any defect in material or workmanship which may occur during proper and normal use during a period of 1 year from date of installation or a maximum of 2 years from date of shipment will be corrected by repair or replacement by the manufacturer, f.o.b. factory.

4.1.5 Qualification Approval. Manufacturers who have met all requirements specified herein will be listed as approved suppliers in AC 150/5345-1, Approved Airport Lighting Equipment. Once approval has been granted, the manufacturer may not make any changes in the connectors without prior FAA approval. Requests for design or component changes must be submitted to the office listed in 4.1.1 and must be accompanied by supporting documentation for the change. Substitution of components which are identical in rating and size and equal or better in quality does not require prior FAA approval.

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4.2 Qualification Tests. Connectors, with conductors attached, shall be subjected to electrical and physical tests. For all tests, Class B connectors shall be assembled in accordance with manufacturer's instructions to lengths of wire or cable, as appropriate, of at least 24 inches (0.6 m). Six pairs of mated connectors shall be selected at random from a production run for each type of connector to be tested for approval.

4.2.1 Dielectric Tests.

4.2.1.1 Plugs and Receptacles. Six test insert plugs made of nylon or equal material of suitable dielectric strength shall be provided for this test. These test plugs shall meet the mating dimensions of the corresponding standard plug intended for use with the receptacle being tested. Each plug shall be checked with "go" and "no go" ring gauges to insure compliance with specified dimensions. Each receptacle under test shall be mated with one of the test plugs and allowed to soak for 24 hours in a tap water bath at room temperature, 20-25°C. At the end of the soaking period, the minimum resistance between conductor(s) and water and between conductors of Class B connectors measured with a 500-volt source shall be 25,000 megohms. These readings shall be taken with the receptacle still immersed. The receptacles having passed this test are now used for testing the corresponding plugs in a like test.

4.2.1.2 Connector Assembly. After the conclusion of the previous test, each type plug and receptacle, being tested for approval, are mated and immersed in tap water as before. While immersed, each connector assembly shall be manually flexed for 2 minutes and then left immersed for a minimum of 24 hours with its cable leads flexed and maintained 180° from its longitudinal axis. Immerse not more than 2 feet (0.6 m) of cable, 1 foot (0.3 m) of the plug, and 1 foot (0.3 m) of the receptacle. Measure the connected assemblies after 24 hours of immersion to determine if they meet the required resistance of 4.2.1.1. This measurement is to be taken 1 minute after a test voltage of 4.7 kV dc has been applied for 5 minutes to Type II connectors and 15 kV dc to Type I connectors. To conclude this test, heat the water to 65°C without removing the assemblies and hold this temperature for at least 1 hour. Again make resistance measurements between conductor(s) and water and between conductors (Class B connectors) with a 500-volt source. The minimum acceptable resistance for these readings shall be 10,000 megohms.

4.2.2 Bond Test. The molded bond between cable and Class A connector shall be subjected to a static longitudinal pull load of the magnitude specified in 3.3.2. Any evidence of separation of the bond will result in rejection.

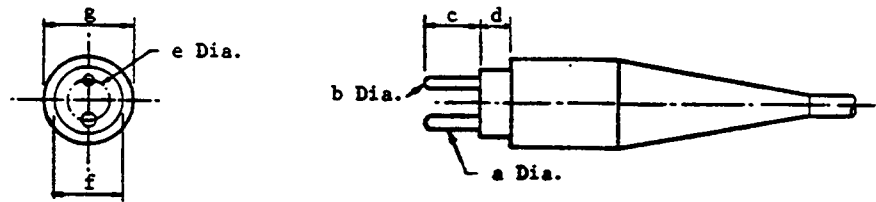
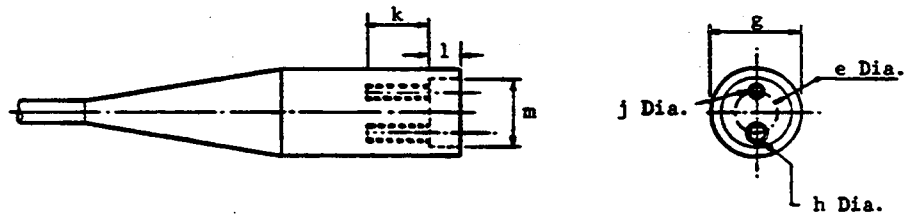
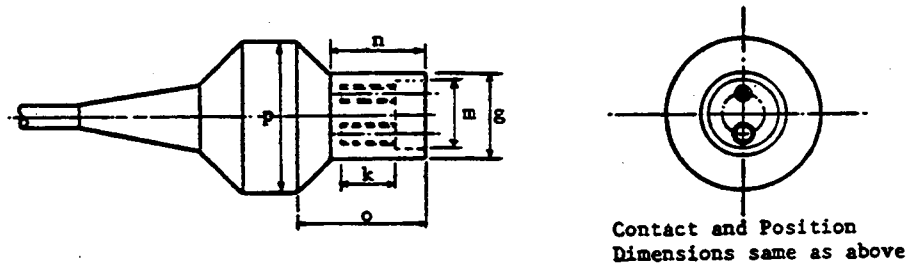
4.2.3 Mechanical Connection Test. Each plug and receptacle intended to be mated shall be connected together and subjected to the static pull load specified in 3.3.3. Any evidence of separation of the connection will be cause for rejection. No damage shall occur to the mating components when the connected plug and receptacle are separated by a greater static pull load.

4.2.4 Electrical Connection Test. Voltage drop measurements shall be made across mated connectors while conducting rated current. Voltage drops in excess of those specified in 3.3.1 will be cause for rejection.



4.2.5 Weathering Test. Class B connectors, being tested for approval, shall be subjected to simulated sunlight according to UL-62, paragraph 74, and exposure to ozone according to ASTM D 1149, with 50 ppm ozone, 38°C, 20 percent sample extension, and 100 hours exposure. Cracking of the connectors as a result of testing shall be evidence of noncompliance.

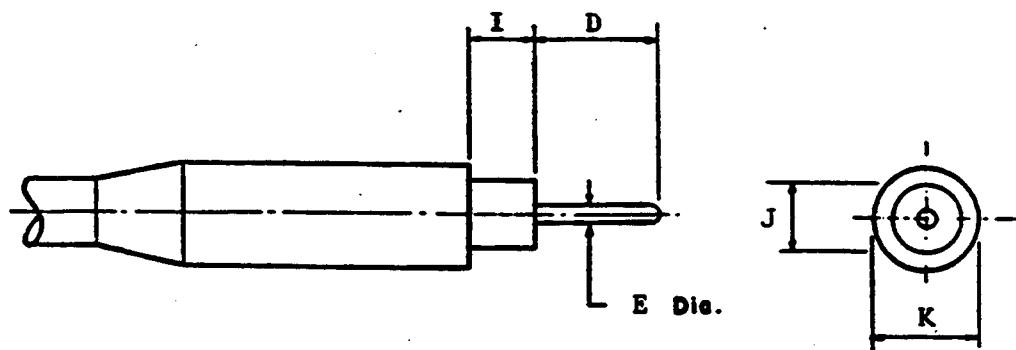


(a) PLUG, Type II, Class A, Style 1(b) RECEPTACLE, Type II, Class A, Style 7(c) RECEPTACLE, Type II, Class A, Style 8

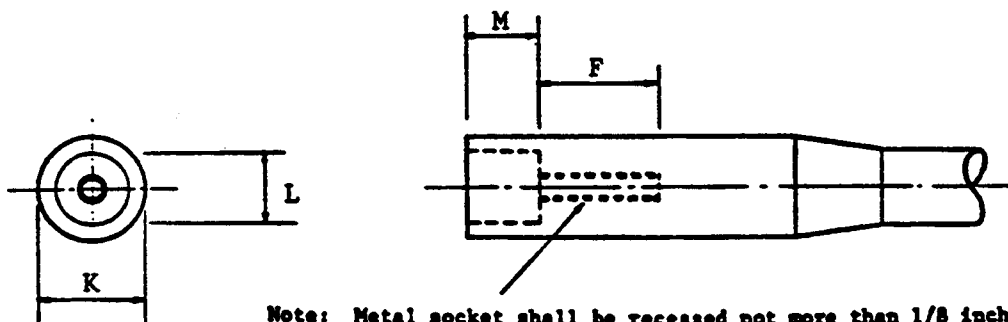
<u>DIMENSION</u>	<u>INCHES</u>	<u>CENTIMETERS</u>	<u>REFERENCE</u>
a	0.155 $\pm$ .001	0.394 $\pm$ .003	Connector for white wire
b	0.124 $\pm$ .001	0.315 $\pm$ .003	Connector for black wire
c	0.625 $\pm$ .015	1.587 $\pm$ .038	Plug pin
d	0.343 $\pm$ .031, -.000	0.871 $\pm$ .079, -.000	Plug
e	0.435 $\pm$ .010	1.105 $\pm$ .025	Plug, Receptacle
f	0.725 $\pm$ .010, -.000	1.841 $\pm$ .025, -.000	Plug
g	1.000 $\pm$ .000, -.031	2.540 $\pm$ .000, -.079	Plug, Receptacle
h	0.157 $\pm$ .001	0.399 $\pm$ .003	Socket dia. before splitting
j	0.126 $\pm$ .001	0.320 $\pm$ .003	Connector for white wire
k	0.641 Min.	1.628 Min.	Socket dia. before splitting
l	0.358 $\pm$ .000, -.015	0.909 $\pm$ .000, -.038	Connector for black wire
m	0.694 $\pm$ .010	1.763 $\pm$ .025	Depth of socket includes .125" (.318 cm) recess below inside face of receptacle
n	1.125 $\pm$ .031	2.857 $\pm$ .079	Receptacle
o	1.500 $\pm$ .031	3.810 $\pm$ .079	Receptacle
p	1.750 $\pm$ .031	4.445 $\pm$ .079	Receptacle

Figure 1. Plug and Receptacles, Two Conductor, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground.

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PLUG, Type I, Class A, Style 2

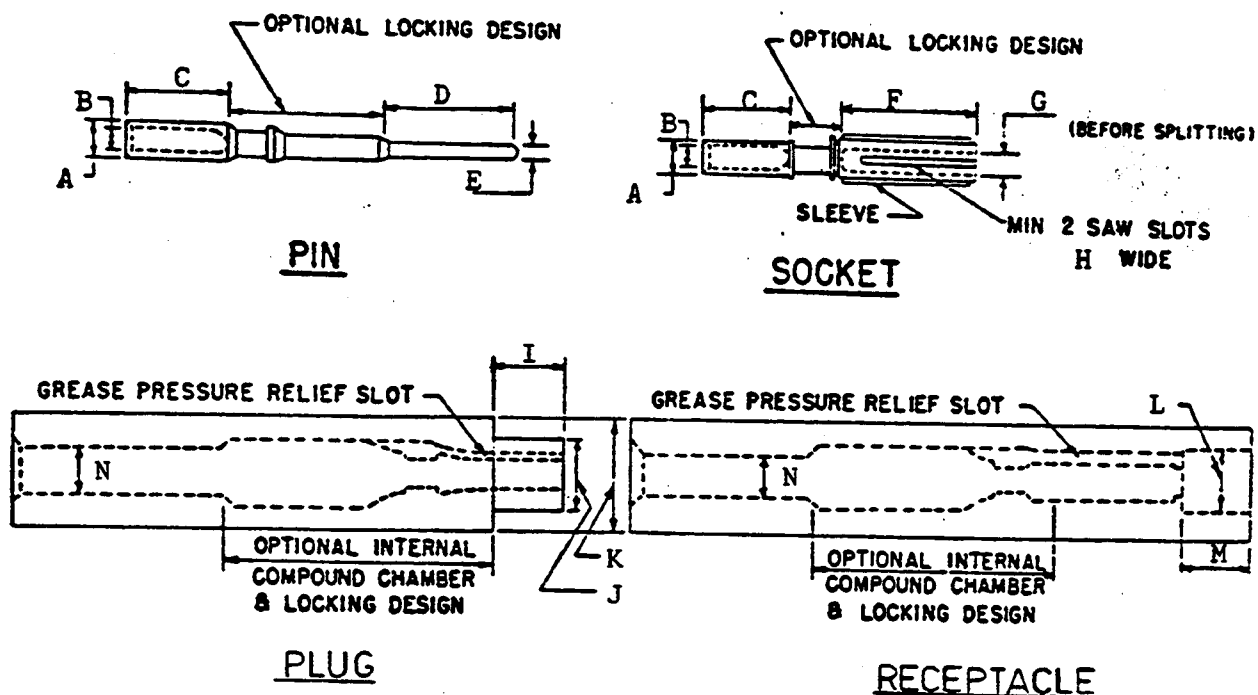


Note: Metal socket shall be recessed not more than 1/8 inch (0.318 cm) below inside face of receptacle and before splitting shall have an I.D. of .188  $\pm$  .001 inch (.478  $\pm$  .003 cm).

RECEPTACLE, Type I, Class A, Style 9

<u>DIMENSION</u>	<u>INCHES</u>	<u>CENTIMETERS</u>
D	1.062 $\pm$ .015	2.697 $\pm$ .038
E	0.186 $\pm$ .001	0.472 $\pm$ .003
F	1.080 Min.	2.743 Min.
I	0.593 $\pm$ .015, -.000	1.506 $\pm$ .038, -.000
J	0.604 $\pm$ .010, -.000	1.534 $\pm$ .025, -.000
K	0.937 $\pm$ .000, -.031	2.380 $\pm$ .000, -.079
L	0.573 $\pm$ .010	1.455 $\pm$ .025
M	0.608 $\pm$ .000, -.015	1.544 $\pm$ .000, -.038

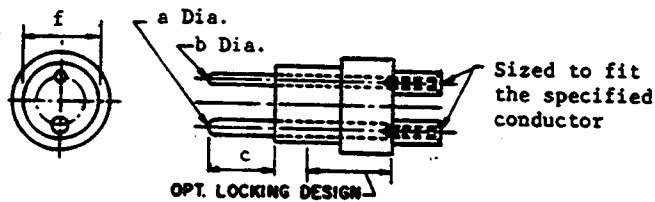
Figure 2. Plug and Receptacle, Single Conductor, 25 Ampere, 5000 Volts to Ground.



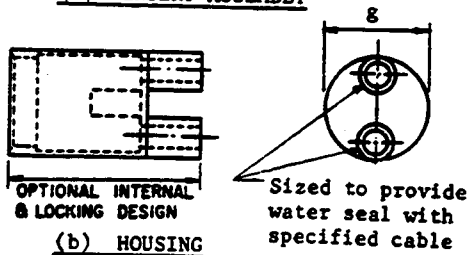
<u>DIMENSION</u>	<u>INCHES</u>	<u>CENTIMETERS</u>	<u>REFERENCE</u>
A,B,C	Dimensioned to provide a compression fitting for the specified cable size.		
D	1.062 $\pm$ .015	2.697 $\pm$ .038	Pin
E	0.186 $\pm$ .001	0.472 $\pm$ .003	Pin
F	1.080 Min.	2.743 Min.	Depth of socket includes .125" (.318 cm) recess below inside face of the receptacle
G	0.188 $\pm$ .001	0.478 $\pm$ .003	Socket
H	0.025 $\pm$ .010	0.064 $\pm$ .025	Socket
I	0.593 $\pm$ .015, -.000	1.506 $\pm$ .038, -.000	Plug
J	0.604 $\pm$ .010, -.000	1.534 $\pm$ .025, -.000	Plug
K	0.937 $\pm$ .000, -.031	2.380 $\pm$ .000, -.079	Plug, Receptacle (K dimension may vary except near mating ends)
L	0.573 $\pm$ .010	1.455 $\pm$ .025	Receptacle
M	0.608 $\pm$ .000, -.015	1.544 $\pm$ .000, -.038	Receptacle
N	Dimensioned to provide a waterproof seal with the cable insulation		

Figure 3. Plug, Type I, Class B, Style 3, and Receptacle, Type I, Class B, Style 10, Single Conductor, 5000 Volt, 25 Ampere.

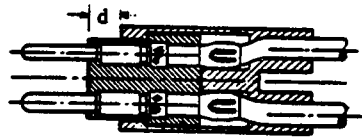
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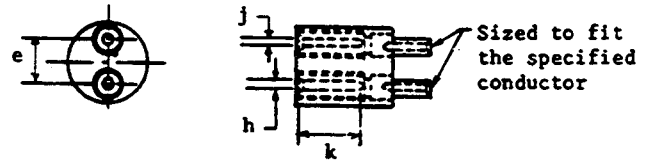
(a) INSERT ASSEMBLY



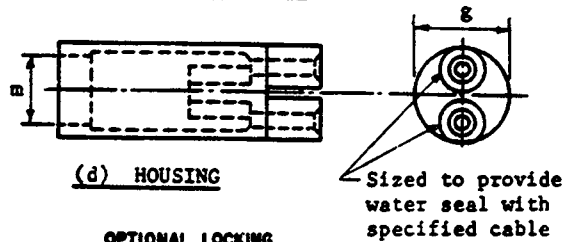
(b) HOUSING



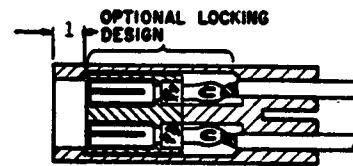
PLUG, a&b Assembled, Style 4



(c) INSERT ASSEMBLY

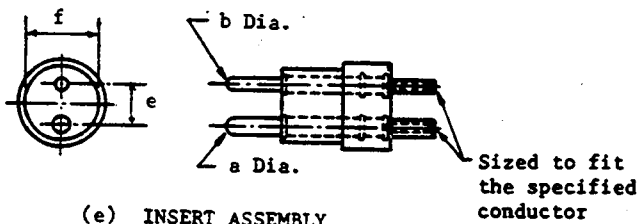


(d) HOUSING

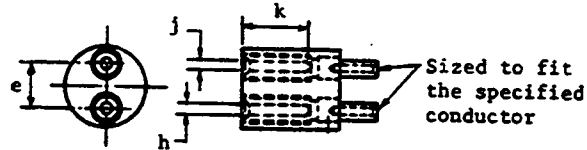


RECEPTACLE, c&d Assembled, Style 11

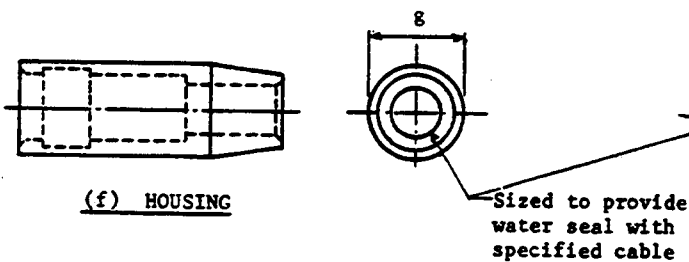
NOTE: See Figure 1 For Dimensions.



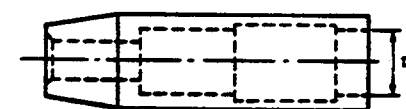
(e) INSERT ASSEMBLY



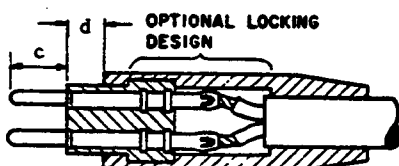
(g) INSERT ASSEMBLY



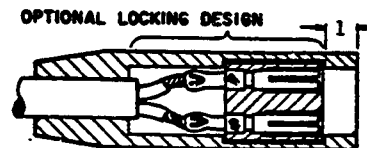
(f) HOUSING



(h) HOUSING



PLUG, e&f Assembled, Style 5



RECEPTACLE, g&h Assembled, Style 12

Figure 4. Plug and Receptacle Kits, Type II, Class B, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground

Contact circle and pin dimensions  
are shown on Figure 1a.

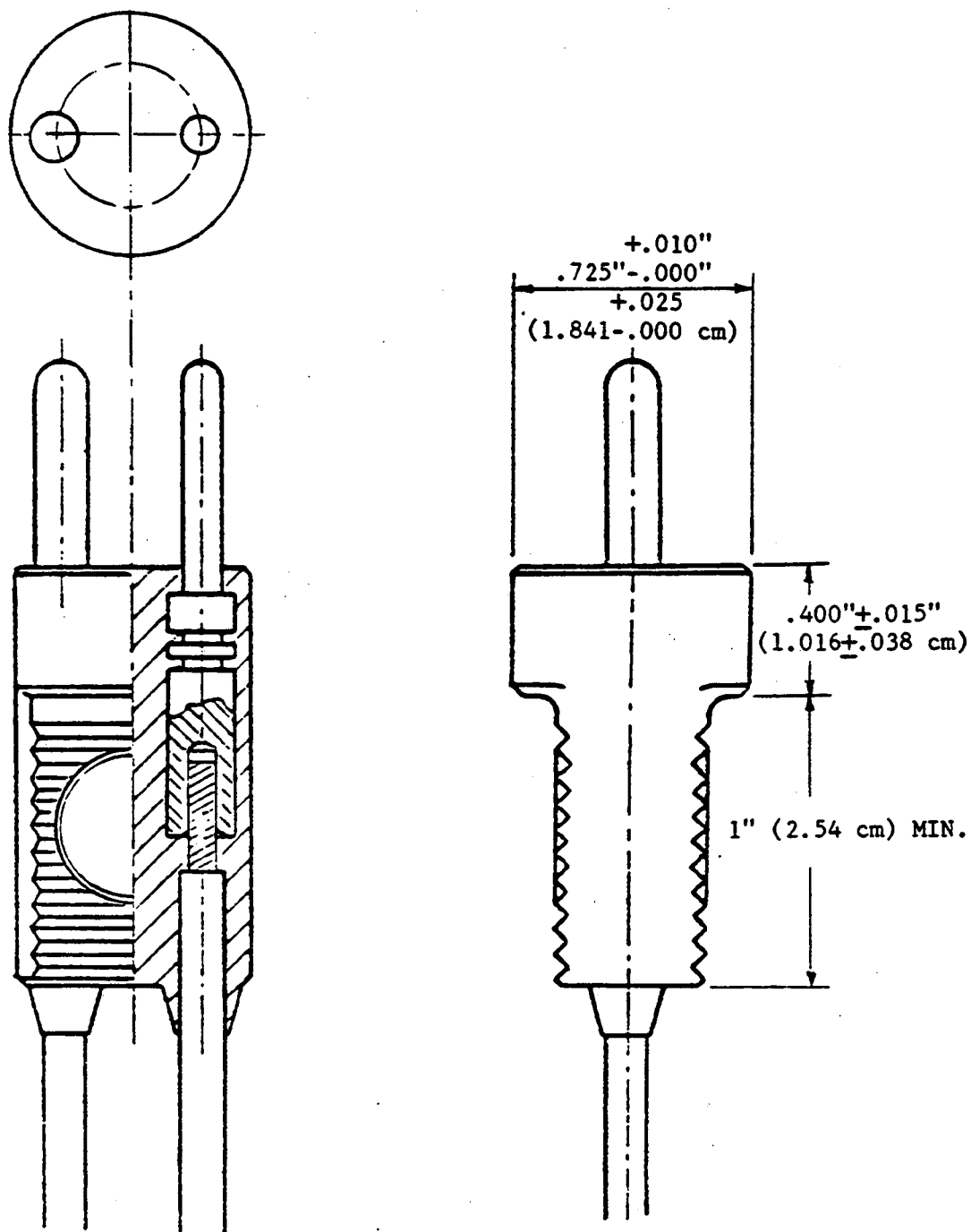


Figure 5. Plug, Two Single Conductors, 20 Ampere, 600 Volts Between Contacts, 1500 Volts to Ground, Type II, Class A, Style 6.





CHANGE 1

DATE 1/4/82

# ADVISORY CIRCULAR

CHANGE



DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

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**Subject:** Change 1 to SPECIFICATION FOR L-823 PLUG AND RECEPTACLE, CABLE CONNECTORS--Revises Equipment Qualification Procedures

1. PURPOSE. This Change revises the procedures for obtaining equipment qualification approval as contained in paragraph 4.
2. EXPLANATION. Procedures for obtaining equipment qualification approval are now contained in AC 150/5345-1G, Approved Airport Lighting Equipment, and supersede those contained in paragraph 4 of this advisory circular.
3. FILING THIS CHANGE. This Change should be filed on the front of the advisory circular. Page changes to reflect this revision will be made at a later date.

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Director, Office of Airport Standards

